ED385780 1995-00-00 Not Just a Number: Critical Numeracy for Adults. ERIC Digest No. 163.

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ERIC Identifier: ED385780
Publication Date: 1995-00-00
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Source: ERIC Clearinghouse on Adult Career and Vocational Education Columbus OH.

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"It is difficult to understand why so many people must struggle with concepts that are actually simpler than most of the ideas they deal with every day. It is far easier to calculate a percentage than it is to drive a car." (Dewdney 1993, p. 1) To many people, the words "math" and "simple" do not belong in the same sentence. Math has such an

aura of difficulty around it that even people who are quite competent in other areas of life are not ashamed to admit they can't "do" math. Innumeracy is more socially acceptable and tolerated than illiteracy (Dewdney 1993; Withnall 1995). Rather than discussing specific ways to teach math to adults, this Digest looks at emerging perspectives on numeracy and their social, cultural, and political implications as a context for new ways of thinking about adult numeracy instruction.

WHAT IS NUMERACY?

Numeracy involves the functional, social, and cultural dimensions of mathematics. Numeracy is the type of math skills needed to function in everyday life, in the home, workplace, and community (Withnall 1995). Although not always recognized as such, math is used in many everyday situations--cooking, shopping, crafts, financial transactions, traveling, using VCRs and microwave ovens, interpreting information in the media, taking medications. Different people need different sets of math skills, and their numeracy needs change in response to changes in life circumstances, such as buying a car or house or learning a new hobby (Gal 1993; Withnall 1995). Like literacy, numeracy "is not a fixed entity to be earned and possessed once and for all" (Steen 1990, p. 214), nor a skill one either has or doesn't have. Instead, people's skills are situated along a continuum of different purposes for and levels of accomplishment with numbers.

Beyond daily living skills, numeracy is now being defined as knowledge that empowers citizens for life in their particular society (Bishop et al. 1993). Thus, numeracy has economic, social, and political consequences for individuals, organizations, and society. Low levels of numeracy limit access to education, training, and jobs; on the job, it can hinder performance and productivity. Lack of numeracy skills can cause overdependence on experts and professionals and uncritical acceptance of charlatans and the claims of pseudoscience (Dewdney 1993). Inability to interpret numerical information can be costly financially; it can limit full citizen participation and make people vulnerable to political or economic manipulation. Like people with low levels of literacy, those lacking numeracy skills sometimes manage to avoid using math, relying on social support networks and coping tricks adapted to their environment (Steen 1990).

MATH MYTHS...AND REAL-LIFE NUMERACY

Why do people avoid math, and why does such a seemingly abstract subject arouse such high emotions? Many myths cloud the perception of math and numeracy (Bishop et al. 1993; Gal 1992; Willis 1992); the realities are discussed in this section.

NUMERACY IS CULTURALLY BASED AND SOCIALLY CONSTRUCTED. The math mystique is fed by stereotypes suggesting that white males and Asians are innately better at math and that math originated in Western civilization (Zaslavsky 1994). However, a new field--ethnomathematics--is emerging to refute these ideas. Researchers in this field are demonstrating that all cultures have math and use it (like

language) as a system for making meaning of the world (NUMERACY IN FOCUS 1995). Math principles and numeracy practices are not universal. Like literacy, numeracy is a set of cultural practices that reflect the particular values of the social, cultural, and historical context (Joram, Resnick, and Gabriele 1994). From the mental math of bazaar merchants to the navigational practices of South Pacific islanders to the astronomical calculations of ancient Mayans, "an enormous range of mathematical techniques and ideas have been developed in all parts of the world" (Bishop et al. 1993, p. 6). Some math activities are widely practiced across cultures--counting, measuring, locating, designing, playing (gambling, guessing), and explaining but there are cultural differences in these "universal" activities (ibid.). Academic math may look the same in many societies because a competitive economic and political ethic demands a competitive math curriculum and dominant cultures may have imposed their math forms on other societies (ibid.).

MATH REFLECTS A PARTICULAR WAY OF THINKING. Why is a computer program considered "real" math and the calculations in knitting a sock are not (Zaslavsky 1994)? Why do people think that math requires special intelligence or a "math mind"? As a particular way of thinking about the world, the math of a particular culture or group can be used as a gatekeeper to restrict access to professions, disproportionately keeping out nondominant groups such as women and minorities (Willis 1992). The behavior and attitudes of the dominant group become the norm against which others are measured. Those whose ways of thinking are attuned to this kind of math succeed where it is used in school and work. Those who think in other ways may be considered lacking in math ability, prompting Willis to ask whether math anxiety is innate or culturally induced. Because math (and numeracy) relates to specific cultural contexts, different cultural groups have different mathematical strengths. Although academic math is used to regulate access to higher education and occupations, academic aptitudes and skills are not necessarily those needed on the job or in life (Gal 1992).

NUMERACY REFLECTS CULTURAL VALUES. Math is often seen as abstract and neutral. In reality, it is a discourse--a way of talking or thinking--that people use to give meaning to the world and therefore it reflects a particular world view (NUMERACY IN FOCUS 1995). For example, consumer education typically uses math to teach about credit, budgeting, and money management. Implicit in these uses of math are the assumptions of a market economy about value for money, investment, and consumption--a hidden curriculum whose values are not shared by all cultures (ibid.).

NUMERACY IS NOT JUST ABOUT NUMBERS. Numeracy is a socially based activity that requires the ability to integrate math and communication skills (Withnall 1995). It is intricately linked to language: words are the tools for translating numerical code and giving it meaning. Words can have everyday meanings as well as math meanings: for example, "and" is a conjunction, but in math it can also mean "plus." Some words are math specific: numerator, multiplicand, divisor. Interpretation of these words can cause confusion for people with low literacy levels or those attempting to become numerate in

a second language.

MATH EVOLVES AND CHANGES. Despite the myth that mathematical principles are fixed for all time, new discoveries and theories about math continue to emerge. The uses of math in the world evolve as societal needs change. For example, computers are changing the need for some kinds of math skills and creating the need for others (Bishop et al. 1993).

NUMERACY IS ABOUT PROCEDURAL, PRACTICAL KNOWLEDGE. This type of knowledge is perceived as less important or prestigious than abstract, theoretical knowledge. Practical, everyday math is considered the "lower end" of the mathematical hierarchy.

NUMERACY INVOLVES DIFFERENT WAYS OF SOLVING PROBLEMS. There is not just one way to get the one right answer. "The students found it helpful to discuss the sort of strategies they use in their real lives. The reinforcement of these strategies not being wrong gave them a lot of confidence. The students were convinced that there was only one way to carry out a process in maths" (Halliday and Marr 1995, p. 75). In traditional teaching, the teacher/authority hands down knowledge to blank-slate students who memorize multiplication tables and formulas and mechanically apply rules to solve problems. However, real-world problems are not as cut and dried as textbook math (Zaslavsky 1994). Intuition, mnemonics, tricks, and other "home-grown" problem-solving methods can complement abstract, formal approaches (ibid.).

IMPLICATIONS FOR ADULT EDUCATION

Numeracy has an uncertain place in adult basic education. Instructors (often volunteers) are not always prepared to teach math and may even share some of their students' anxieties about it. Adult math instruction often focuses on preparation for the General Educational Development Test, which is based on high school math and perhaps "cannot serve as a complete road map for what adult numeracy provision should encompass" (Gal 1992, p. 22). The concepts of numeracy and math explored in this digest suggest that numeracy instruction should be based on the belief that everyone can do math and everyone uses numeracy practices that may go unrecognized. Taking a broad view of numeracy, educators take learners' existing reasoning skills, experience, and literacy and language abilities as the context for what learners need to learn (ibid.).

Literacy and numeracy should be linked and contextualized. Math is better understood if learned in familiar contexts that may provide cues to enhance problem solving. Familiar contexts may make math more accessible for those who have been alienated from it (NUMERACY IN FOCUS 1995). Having learners keep journals develops language and math skills together, helps them verbalize their thought processes, and enables them to express emotional reactions and feelings about math (Halliday and Marr 1995). Contextualized math applies a constructivist approach to learning, in which people

relate new knowledge to what they already know, construct their own understanding, and make new meanings. This approach can help learners recognize the math characteristics of everyday situations (Gal 1992). Contextualized math can also help those learners with different ways of thinking. Individual learning style preferences should be considered in numeracy instruction (Zaslavsky 1994).

Adult educators should also consider their philosophical approach to education as well as numeracy. Critical numeracy means that learners empowered with functional skills can participate fully in civic life, skeptically interpret advertising and government statistics, and take political and social action. In opposition to the perspective that blames innumerate people for their own difficulties, educators can use language, literacy, and numeracy as vehicles for examining how society positions people and treats them differently (Shore et al. 1993).

Teaching from the perspective of adult education as a tool for social justice, instructors seek to change the system in which math serves as a barrier and to "equip people with the knowledge and tools that will enable them to examine and criticize the economic, political, and social realities of their lives" (Zaslavsky 1994, p. 217). An inclusive approach to instruction recognizes the different power relations in the way math and numeracy are viewed and used and seeks to give people a voice and more control over life circumstances (Shore et al. 1993). At the same time, educators can also empower learners with the numeracy skills needed to function in the technological society and workplace. As more learners acquire those skills, the cultural practices that are numeracy as well as the way math serves society can be changed.

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Title: Not Just a Number: Critical Numeracy for Adults. ERIC Digest No. 163.
Document Type: Information Analyses---ERIC Information Analysis Products (IAPs) (071); Information Analyses---ERIC Digests (Selected) in Full Text (073);
Descriptors: Adult Basic Education, Adult Learning, Basic Skills, Daily Living Skills, Educational Philosophy, Educational Theories, Mathematics Anxiety, Mathematics Instruction, Numeracy, Political Influences, Socioeconomic Influences, Teaching Methods
Identifiers: ERIC Digests
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